IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Sebastien KERDILES et al.	Confirmation No.: 8821
Application No.: 10/733,470	Patent No.: 7,187,162 B2
Filing Date: December 12, 2003	Patent Date: March 6, 2007
For: TOOLS AND METHODS FOR DISUNITING SEMICONDUCTOR WAFERS	Attorney Docket No.: 4717-9100

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 C.F.R. § 1.322

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Patentees hereby respectfully request the issuance of a Certificate of Correction in connection with the above-identified patent. The corrections are listed on the attached Form PTO-1050. The corrections requested are as follows:

Title Page:

Item (75) Inventors, change "**Yves-Mathieu**" to -- **Yves-Matthieu** --. Support for this change appears on the corrected Declaration filed with the Request for Correction of Filing Receipt on November 21, 2006.

Column 10:

Line 34 (claim 2, line 1), after "The tool according to claim **1**, wherein one" insert -- or each gripper member --. Support for this change appears in application claim 2.

The requested corrections are for errors that appear to have been made by the Office. Therefore, no fee is believed to be due for this request. Should any fees be required, however, please charge such fees to Winston & Strawn LLP Deposit Account No. 50-1814. Please issue a Certificate of Correction in due course.

Respectfully submitted,

3-16-07
Date

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WINSTON & STRAWN LLP
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212-294-3311

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO.: 7,187,162 B2
APPLICATION NO.: 10/733,470
DATED: Mar. 6, 2007
INVENTOR(S): Kerdiles et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title Page:
Item (75) Inventors, change "**Yves-Mathieu**" to -- **Yves-Matthieu** --.

Column 10:
Line 34 (claim 2, line 1), after "The tool according to claim **1**, wherein one" insert -- or each gripper member --.

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(12) **United States Patent**
Kerdiles et al.

(10) **Patent No.: US 7,187,162 B2**
(45) **Date of Patent: Mar. 6, 2007**

(54) **TOOLS AND METHODS FOR DISUNITING SEMICONDUCTOR WAFERS**

(75) Inventors: **Sebastien Kerdiles**, Saint-Ismier (FR); Yves-Matthieu **Yves-Mathieu Le Vaillant**, Grenoble (FR)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 172 days.

(21) Appl. No.: **10/733,470**

(22) Filed: **Dec. 12, 2003**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
G01R 31/28 (2006.01)

(52) **U.S. Cl.** **324/158.1**; 156/344; 156/584

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

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WO	WO 00/26000	5/2000

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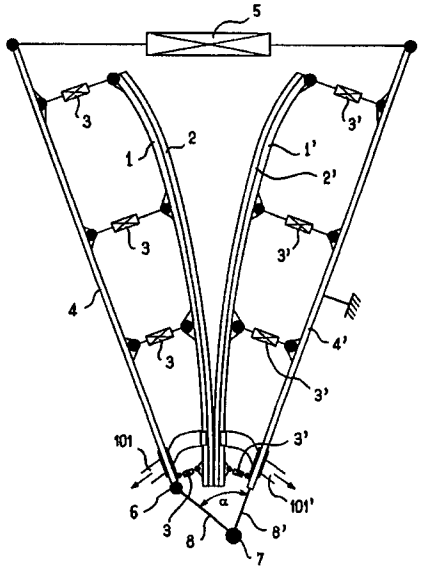
(57) **ABSTRACT**

A tool for disuniting two wafers, at least one of which is for use in fabricating substrates for microelectronics, optoelectronics, or optics, the tool comprising two gripper members suitable for being fixed temporarily to respective opposite faces of the two wafers that are united with each other, and a disuniting control device suitable for moving said members relative to each other. The tool is remarkable in that the disuniting control device comprises an actuator for positively displacing said gripper members and for inducing controlled flexing in at least one of said members. This makes it easier to disunite the wafers while reducing the risk of damaging them. The invention is applicable to disuniting wafers that have been weakened by implantation, that have been temporarily bonded together, etc.

29 Claims, 10 Drawing Sheets



exerted makes it possible to vary disuniting conditions at will. It is also possible to make use of hydraulic pressure which raises in quasi-static manner, or in pulsed manner, which pulses can be isolated or repetitive, etc.

In this respect, when disuniting using conventional techniques, in a direction which is generally perpendicular to the substrate, variations are observed in the result depending on the way in which stress is applied. With the present invention, this latitude of utilization makes it possible additionally to study the dynamics of disuniting, in particular when fracturing a zone that has been weakened by using a SMART-CUT® method.

It should also be observed that the tool of the present invention makes it possible to work at temperatures other than ambient temperature. In this respect, some kinds of bonding take place a temperatures of 150° C. and higher, and it will be understood that it is advantageous, for example for reasons of differential expansion, to be able to perform disuniting likewise at high or low temperatures. The person skilled in the art knows how to design the various parts constituting a tool as a function of the temperatures to which it is to be exposed.

The advantages of the present invention are now described.

The main advantage of the tool and of the associated technique is to be able to perform disuniting by applying stress that can possibly be very large, but without breaking nor even damaging the detached wafers. In this respect, by controlling flexing of the plates, it is possible to exert a large force close to one edge of the wafers to be disunited without inducing excessive flexing of said wafers, and on each occasion initiating disuniting in the weakest plane (contrary to techniques that make use of a blade).

As mentioned, the disuniting energy that is applied may be very large. It is limited practically only by the suction force applied through the diaphragms **102**, **102'**. This tool thus makes it possible to disunite so-called "dismountable" substrates where bonding energies are very high.

As also mentioned, by using hydraulic or equivalent actuators, the invention makes it possible to modulate energy as a function of time. In particular, during development stages prior to production, it is possible specifically to investigate responses to different applied pressures such as energy pulses (shock dynamics), or to variations of energy that on the contrary are very slow, or to repeated pulses suitable for giving rise to fatigue fractures.

Finally, and above all, by controlling the bending of the plates **1**, **1'** and thus of the wafers **2**, **2'** while they are being disunited, and by doing so independently of the traction that is exerted for disuniting purposes, it is possible to preserve said wafers. Thus, unlike techniques using a blade, the present case avoids plastic deformation or even breakage of the wafers while they are being disunited.

Another advantage provided by precise control of wafer bending, as compared with blade systems which cause each of the wafers to be deformed as a function of its own capacity for deformation (associated with its Young's modulus, its diameter, and its thickness), is that it is possible to preserve one of the two wafers (for example a wafer carrying a fragile layer or an active layer of a component) by keeping it plane, with bending being imposed on the other wafer, even if the other wafer is more rigid.

Finally, for research and development activity, the present invention is useful in several regards. Thus, contrary to techniques that make use of a blade, the present invention makes it possible to measure bonding energy by stopping propagation of the disuniting front at any time. In addition, the actuators can at all times deliver accurate and direct measurements of the applied stress and no mathematical computation is needed in addition.

Numerous variants can be applied to the invention. In particular, in a variant, the gripper plates **1**, **1'** can be secured to the wafers **2**, **2'** that are to be disunited by bonding using electrostatic forces, by bringing the set of wafers **2**, **2'** and the plates **1**, **1'** to appropriate potentials.

In particular, Coulomb or Johnson-Rahbeck electrostatic force plates and proposed in U.S. Pat. Nos. 6,351,367 or 6,215,643 can be used instead of the suction plates described above. Such plates are generally made of a dielectric material coating a metal electrode. A potential applied to the electrode, for example of the order of a few hundreds of volts, enables bonding forces to be generated that can be as great as about 500 grams per square centimeter (g/cm^2), which force is entirely suitable for use in the context of the present invention.

What is claimed is:

1. A tool for disuniting two wafers, with at least one of the wafers being used in fabricating substrates for microelectronics, optoelectronics, or optics, the tool comprising two flexible gripper members for temporarily affixing to respective opposite faces of the wafers that are united to each other, and a disuniting control device suitable for moving the members relative to each other, wherein the disuniting control device comprises an actuator device for positively displacing the gripper members away from each other sufficiently for inducing controlled flexing in at least one of the members to assist in disuniting the wafers, wherein at least one flexible gripper member is configured in dimension to apply different degrees of elastic deformability in at least two locations.

2. The tool according to claim **1**, wherein one or each gripper member comprises a diaphragm having a plurality of orifices communicating on one side with a respective wafer face and on the other side with a vacuum source.

3. The tool according to claim **1**, wherein one or each gripper member comprises an electrode which has a different potential compared to that of a respective wafer face so as to provide temporary affixing by electrostatic forces.

4. The tool according to claim **1**, wherein the actuator device includes at least two actuators for acting on at least one gripper member at at least two distinct locations.

5. The tool according to claim **1**, wherein at least one gripper member includes a member for limiting flexing.

6. The tool according to claim **1**, wherein the two gripper members are mounted to pivot relative to each other, and wherein the actuator device acts at a distance from the pivot region.

7. The tool according to claim **1**, wherein the actuator device comprises one or more hydraulic actuators.

8. The tool according to claim **1**, further comprising a device for measuring forces exerted by at least one of the actuators or spacing between the wafers.

9. An assembly for disuniting a plurality of pairs of united wafers in series, the assembly comprising a plurality of tools according to claim **1**, and a common actuator device engager for jointly displacing at least one gripper member of each tool relative to the other gripper member to simultaneously disunite the wafers.

10. The tool according to claim **2**, wherein the orifices are micropores.

11. The tool according to claim **3**, wherein each gripper member that includes an electrode further comprises dielectric material which surrounds the electrode.